

## Claims

1. A method of manufacturing a semiconductor device, comprising the steps of:

pre-coating a pre-coating film, which differs from a film to be formed to a substrate, to a processing chamber inside,

forming the film to the substrate in the processing chamber after the pre-coating, and

cleaning the processing chamber inside by supplying a reactant into the processing chamber after forming the film,

wherein, in the cleaning step, the film adhered to the processing chamber inside is removed together with the pre-coating film by reacting the reactant with the pre-coating film without substantially reacting with the film adhered to the processing chamber inside in the film forming step.

2. A method of manufacturing a semiconductor device, comprising the steps of:

pre-coating a pre-coating film, which differs from a film to be formed to a substrate, to a processing chamber inside,

forming the film to the substrate in the processing chamber after the pre-coating, and

cleaning the processing chamber inside by supplying a reactant into the processing chamber after forming the film,

wherein, in the cleaning step, a film adhered to the

processing chamber inside is removed together with the pre-coating film by making such that an etching rate of the pre-coating film becomes higher than an etching rate of the film adhered to the processing chamber inside in the film forming step.

3. A method of manufacturing a semiconductor device, comprising the steps of:

pre-coating a pre-coating film, which consists of a material other than a High-k film, to a substrate processing chamber inside,

forming the High-k film to a substrate in the processing chamber after the pre-coating, and

cleaning the processing chamber inside by supplying a reactant into the processing chamber after forming the film,

wherein, in the cleaning step, the High-k film adhered to the processing chamber inside is removed together with the pre-coating film by making a cleaning temperature into a temperature of such a degree that the reactant reacts with the pre-coating film without reacting with the High-k film adhered to the processing chamber inside.

4. A method of manufacturing a semiconductor device, comprising the steps of:

pre-coating a pre-coating film, which consists of a material other than a High-k film, to a substrate processing chamber inside,

forming the High-k film to a substrate in the processing chamber after the pre-coating, and

cleaning the processing chamber inside by supplying a reactant into the processing chamber after forming the film,

wherein, in the cleaning step, a cleaning temperature is made a temperature within a range not lower than 100°C and not higher than 400°C.

5. A method of manufacturing a semiconductor device according to claim 1, wherein, in the film forming step, a High-k film is formed.

6. A method of manufacturing a semiconductor device according to claim 5, wherein the High-k film is a film containing Hf.

7. A method of manufacturing a semiconductor device according to claim 6, wherein the film containing Hf is an  $\text{HfO}_2$  film or an Hf silicate film.

8. A method of manufacturing a semiconductor device according to claim 5, wherein, in the pre-coating step, a film containing Si is pre-coated.

9. A method of manufacturing a semiconductor device according to claim 8, wherein the film containing Si is a film of at least one kind selected from a group consisting of  $\text{SiO}_2$ , Si or SiC.

10. A method of manufacturing a semiconductor device according to claim 8, wherein the reactant used in the cleaning

step contains F or Cl.

11. A method of manufacturing a semiconductor device according to claim 8, wherein the reactant used in the cleaning step is an active species obtained by activating a gas containing F or Cl by a plasma.

12. A method of manufacturing a semiconductor device according to claim 8, wherein the reactant used in the cleaning step is an active species obtained by activating a mixed gas of a gas containing F or Cl and Ar by a plasma.

13. A method of manufacturing a semiconductor device according to claim 8, wherein the reactant used in the cleaning step is F\* or Cl\*.

14. A method of manufacturing a semiconductor device according to claim 8, wherein, in the cleaning step, a cleaning temperature is made a temperature within a range not lower than 100°C and not higher than 400°C.

15. A method of manufacturing a semiconductor device according to claim 10, wherein, in the processing chamber inside, an Al-made member exists.

16. A method of manufacturing a semiconductor device according to claim 10, wherein the processing chamber is a cold wall type.